

REMARKS

Claims 1, 10 and 16 are amended. Claims 1-23 are pending in the application.

Claims 1-4, 6-16 and 18-23 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Chen (U.S. Patent No. 5,356,478); in view of Cotte (U.S. Patent No. 6,454,869). The Examiner is reminded by direction to MPEP § 2143 that a proper obviousness rejection has the following three requirements: 1) there must be some suggestion or motivation to modify or combine reference teachings; 2) there must be a reasonable expectation of success; and 3) the combined references must teach or suggest all of the claim limitations. Claims 1-4, 6-16 and 18-23 are allowable over the combination of Chen and Cotte for at least the reason that the references, individually or in combination, fail to disclose or suggest each and every element in any of those claims.

As amended, independent claim 1 recites a method of cleaning a processing chamber by contacting residue material over at least one internal chamber surface with a supercritical fluid where the residue is formed during one or more processing events conducted within the processing chamber. Claim 1 further recites providing the supercritical fluid in the processing chamber where the supercritical fluid comprises at least one of C_3H_8 , N_2O , C_2H_6 , CH_4 , H_2O , Ar and NH_3 . The amendment to claim 1 incorporates subject matter from dependent claim 10. Cotte teaches a cleaning apparatus specially designed for cleaning purposes, with placement of objects to be cleaned into such apparatus (Fig. 1, col. 2, ll. 37-65). Cotte does not disclose or suggest the claim 1 recited cleaning of chamber walls or the recited cleaning of residue material over internal chamber surfaces utilizing supercritical fluid. Nor does Cotte teach or suggest providing supercritical fluid within a processing chamber where the supercritical fluid comprises at least one of

C_3H_8 , N_2O , C_2H_6 , CH_4 , H_2O , Ar and NH_3 .

As acknowledged by the Examiner at page 3 of the present Action, Chen does not teach or suggest the claim 1 recited utilization of supercritical fluid for cleaning residue from chamber walls. Accordingly, as combined with Cotte, Chen fails to contribute toward suggesting the claim 1 recited providing a supercritical fluid in a processing chamber for removing at least some residue material from over at least one internal chamber surface, or the recited supercritical fluid comprising at least one of C_3H_8 , N_2O , C_2H_6 , CH_4 , H_2O , Ar and NH_3 . Accordingly, independent claim 1 is not rendered obvious by the combination of Cotte and Chen and is allowable over these references.

Dependent claim 10 is amended to properly depend from base claim 1. Dependent claims 3-4 and 6-15 are allowable over the combination of Chen and Cotte for at least the reason that they depend from allowable base claim 1.

As amended, independent claim 16 recites providing a processing deposition system comprising a deposition chamber, a processing reagent inlet, a cleaning agent inlet, a cleaning agent source, a cleaning agent recovery vessel and a return line to recycle cleaning agent from the recovery vessel to the cleaning agent source. Claim 16 further recites providing a cleaning agent comprising carbon dioxide from the source into at least a portion of the deposition system where the carbon dioxide comprises either a liquid phase or a supercritical phase, and contacting deposited material on an internal surface with the cleaning agent to solubilize at least a portion of the deposited material. The amendment to claim 16 is supported by the specification at, for example, Fig. 1 and paragraphs 25, 30 and 34. As indicated above, Cotte teaches an apparatus specifically designed to perform cleaning functions where objects are placed within the system for cleaning purposes.

Chen discloses cleaning a chamber and specifies utilization of a gas, specifically an oxidizing gas and a chlorine based gas, and optionally a fluorine based gas. Chen teaches an advantage of not opening the chamber between processing events. Considered in combination, the specialized cleaning chamber of Cotte and the gas cleaning process of Chen do not disclose or suggest the claim 16 recited providing a processing deposition chamber comprising a processing reagent inlet and a cleaning reagent inlet, and having a cleaning reagent source and a return line to recycle the cleaning agent from the recovery vessel to the cleaning agent source, and providing a cleaning agent comprising carbon dioxide from the source inlet into at least a portion of the deposition system. As recited in independent claim 16 and as set forth in applicant's specification at paragraph 34, the recited system allows cleaning agent recovery and recycling. None of the art of record has a processing deposition system having such features.

The methodology using the system of the present invention as recited in claim 16 is additionally advantageous as set forth in paragraph 24 in that additional processing equipment or tools can be placed into the chamber specifically for the cleaning process. Accordingly, rather than utilizing specially designed cleaning equipment as required by Cotte, thereby requiring additional equipment, or the gas cleaning process of Chen which occurs between processing events without opening the chamber, the present system allows flexibility to add additional equipment and tools to the chamber, produces effective cleaning and allows recovery and recycling of the cleaning agent. Such is not disclosed or suggested by the combination of Chen and Cotte. Accordingly, claim 16 is allowable over the cited references.

Dependent claims 18-23 are allowable over the combination of Chen and Cotte for

at least the reason that they depend from allowable base claim 16.

Dependent claim 5 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over the combination of Chen and Cotte as further combined with Goffnett (U.S. Patent No. 5,108,512). Goffnett is indicated as being relied upon as disclosing a method for removing material from an inner surface of a CVD chamber utilizing pellets of carbon dioxide. However, as combined with Chen and Cotte as described above, the carbon dioxide pellets disclosed by Goffnett does not contribute towards suggesting the claim 1 recited use of a supercritical fluid or the recited supercritical fluid comprising at least one of C_3H_8 , N_2O , C_2H_6 , CH_4 , H_2O , Ar and NH_3 . Accordingly, independent claim 1 is not rendered obvious by the combination of Chen, Cotte and Goffnett. Independent claim 5 is therefore allowable over Chen, Cotte and Goffnett for at least the reason that it depends from allowable base claim 1.

Claim 17 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Chen in view of Cotte, in further view of Smith (U.S. Patent No. 5,417,768). Smith is indicated as being relied upon as disclosing removal of residue from a surface by treating with a primary solvent followed by flushing the solvent from the vessel and subsequently utilizing carbon dioxide under supercritical conditions. Applicant notes however that the Smith disclosure also discloses placement of work pieces into a vessel which is specifically designed for cleaning purposes (see drawings and text at col. 3, ll. 35-51 and col. 4, ll. 38-39). When considered in combination with Cotte and Chen, the Smith disclosure of cleaning objects with a vessel particularly configured for such cleaning fails to contribute anything towards suggesting the claim 16 recited providing a processing deposition system having a deposition chamber, a processing reagent inlet, a cleaning agent inlet, a cleaning

agent source, a cleaning agent recovery vessel and a return line to recycle the cleaning agent from the recovery vessel to the cleaning agent source. Nor does Smith contribute towards suggesting the claim 16 recited providing a cleaning agent comprising carbon dioxide from the source into a portion of the deposition chamber and contacting deposited material on an internal surface at least a portion of the deposition system. Independent claim 16 is therefore not rendered obvious by the cited combination of Chen, Cotte and Smith. Dependent claim 17 is allowable over the combination of Chen, Cotte and Smith for at least the reason that it depends from allowable base claim 16.

For the reasons discussed above, claims 1-23 are allowable. Accordingly, applicant respectfully requests formal allowance of such claims in the Examiner's next action.

Respectfully submitted,

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